CLAIMS

What is claimed is:

1. An optical wave-guide absorption cell, comprising:

a first wave-guide;

a holey wave-guide adapted to contain a selective absorption medium, wherein a first terminus of said holey wave-guide is coupled to a first terminus of said first wave-guide; and

a second wave-guide, wherein a first terminus of said second wave-guide is coupled to a second terminus of said holey wave-guide.

2. The optical wave-guide absorption cell according to Claim 1, wherein said first terminus of said holey wave-guide is coupled to said first terminus of said first wave-guide utilizing a fusion splice.

3. The optical wave-guide absorption cell according to Claim 1, wherein said first terminus of said holey wave-guide is coupled to said first terminus of said first wave-guide utilizing a light transmitting adhesive.

4. The optical wave-guide absorption cell according to Claim 1, wherein said holey wave-guide comprises:

a core; and

a plurality of voids formed in said core.

5. The optical wave-guide absorption cell according to Claim 4, wherein said holey wave-guide further comprises a fill hole formed in said core, adapted to introduce said selective absorption medium into said plurality of voids.

6. The optical wave-guide absorption cell according to Claim 1, wherein:

said first wave-guide comprises a first fiber optic cable;

said holey wave-guide comprises a holey fiber optic cable; and

said second wave-guide comprises a second fiber optic cable.

7. A fiber optic absorption cell, comprising a holey fiber optic cable adapted for propagating an optical signal, wherein said holey fiber optic cable comprises:

a core;

a plurality of voids formed in said core;

a selective absorption medium contained in said plurality of voids; and

a fill hole formed in said core, adapted to introduce said selective absorption medium into said plurality of voids.

8. The fiber optic absorption cell according to Claim 7, wherein said holy fiber optic cable further comprises an evacuation hole formed in said core, adapted to introduce said selective absorption medium into said plurality of voids.

9. The fiber optic absorption cell according to Claim 7, further comprising a first fiber optic cable attached to a first terminus of said holey fiber optic cable, adapted to couple said optical signal from a light source to said holey fiber optic cable.

10. The fiber optic absorption cell according to Claim 7, further comprising a second fiber optic cable attached to a second terminus of said holey fiber optic cable, adapted to couple said optical signal from said holey fiber optic cable to a detector.

11. A system for performing spectroscopy comprising:

a holey fiber optic cable containing a known absorptive medium coupled to an optical signal, wherein an optical signal substantially propagates in said known selective absorptive medium;

an optical receiver coupled to said holey fiber optic cable, wherein an electrical signal is generated as a function of said optical signal after propagating in said known selective absorptive medium; and

a signal processing unit coupled to said optical receiver wherein a characteristic of said optical signal after propagating in said known selective absorptive medium is measured as a function of said electrical signal.

12. The system for performing spectroscopy according to claim 11, wherein said holey fiber optic cable comprises one or more fiber Bragg gratings.

13. The system for performing spectroscopy according to claim 11, wherein said one or more fiber Bragg gratings comprise a resonant structure, wherein the effective interaction length of said holey fiber optic cable is increased.

14. The system for performing spectroscopy according to claim 11, wherein said one or more fiber Bragg gratings comprise a resonant structure, wherein a secondary period transmission pattern is generated.

15. The system for performing spectroscopy according to claim 11, further comprising a first fiber optic cable for coupling said optical signal to said holey fiber optic cable.

16. The system for performing spectroscopy according to claim 15, further comprising a second fiber optic cable for coupling said optical signal after propagating in said known selective absorptive medium from said holey fiber optic cable to said optical receiver.

17. The system for performing spectroscopy according to claim 16, wherein:

said first fiber optic cable comprise a first fiber Bragg grating; and

said second fiber optic cable comprises a second fiber Bragg grating.

18. The system for performing spectroscopy according to claim 17, wherein said first fiber Bragg grating and said second fiber Bragg grating comprise a resonant structure, wherein the effective interaction length of said holey fiber optic cable is increased.

19. The system for performing spectroscopy according to claim 17, wherein said first fiber Bragg grating and said second fiber Bragg grating comprise a resonant structure, wherein a secondary period transmission pattern is generated.

20. The system for performing spectroscopy according to claim 16, further comprising :

a first dielectric mirror coupled between said first fiber optic cable and said holey fiber optic cable; and

a second dielectric mirror coupled between said second fiber optic cable and said holey fiber optic cable.

21. The system for performing spectroscopy according to claim 20, wherein said first dielectric mirror and said second dielectric mirror comprise a resonant structure, wherein the effective interaction length of said holey fiber optic cable is increased.

22. The system for performing spectroscopy according to claim 20, wherein said first dielectric mirror and said second dielectric mirror comprise a resonant structure, wherein a secondary period transmission pattern is generated.

23. The system for performing spectroscopy according to claim 11, further comprising a reference optical signal generator coupled to said optical receiver, wherein said reference optical signal generator is utilized to calibrate said optical receiver.

24. A system for performing spectroscopy comprising:

an optical source for generating an optical signal having a known spectral characteristic;

a holey fiber optic cable containing a substance under test coupled to an optical signal, wherein said optical signal substantially propagates in said substance under test;

an optical receiver coupled to said holey fiber optic cable, wherein an electrical signal is generated as a function of said optical signal after propagating in said substance under test; and

a signal processing unit coupled to said optical receiver wherein a characteristic of said optical signal after propagating in said substance under test is measured as a function of said electrical signal.

25. The system for performing spectroscopy according to claim 24, wherein the substance under test is identified as a function of said characteristic.

26. The system for performing spectroscopy according to claim 24, wherein said holey fiber optic cable comprises one or more fiber Bragg grating pairs.

27. The system for performing spectroscopy according to claim 24, wherein said one or more fiber Bragg grating pairs comprise a resonant structure, wherein the effective interactive length of said holey fiber optic cable is increased.

28. The system for performing spectroscopy according to claim 24, wherein said one or more fiber Bragg grating pairs comprise a resonant structure, wherein a secondary period transmission pattern is generated.

29. The system for performing spectroscopy according to claim 24, further comprising a first fiber optic cable for coupling said optical signal from said optical source to said holey fiber optic cable.

30. The system for performing spectroscopy according to claim 29, further comprising a second fiber optic cable for coupling said optical signal after propagating in said substance under test from said holey fiber optic cable to said optical receiver.

31. The system for performing spectroscopy according to claim 30, wherein:

said first fiber optic cable comprise a first fiber Bragg grating; and

said second fiber optic cable comprises a second fiber Bragg grating.

32. The system for performing spectroscopy according to claim 31, wherein said first fiber Bragg grating and said second fiber Bragg grating comprise a resonant structure, wherein the effective interactive length of said holey fiber optic cable is increased.

33. The system for performing spectroscopy according to claim 31, wherein said first fiber Bragg grating and said second fiber Bragg grating comprise a resonant structure, wherein a secondary period transmission pattern is generated.

34. The system for performing spectroscopy according to claim 30, further comprising:

a first dielectric mirror coupled between said first fiber optic cable and said holey fiber optic cable; and

a second dielectric mirror coupled between said second fiber optic cable and said holey fiber optic cable.

35. The system for performing spectroscopy according to claim 34, wherein said first dielectric mirror and said second dielectric mirror comprise a resonant structure, wherein the effective interaction length of said holey fiber optic cable is increased.

36. The system for performing spectroscopy according to claim 35, wherein said first dielectric mirror and said second dielectric mirror comprise a resonant structure, wherein a secondary period transmission pattern is generated.

37. The system for performing spectroscopy according to claim 24, further comprising said optical source coupled to said optical receiver, wherein said optical signal is utilized to calibrate said optical receiver.

38. A method of optical spectrum analysis comprising:

propagating an optical signal along a holey fiber optic cable containing a known selective absorption medium; and

determining a characteristic of said optical signal as a function of said known selective absorption medium.

39. The method according to Claim 38, wherein said optical signal comprises a narrowband optical signal having a wavelength varying as a function of time.

40. The method according to Claim 39, further comprising receiving said optical signal from a tunable laser source (TLS).

41. The method according to Claim 38, wherein said optical signal comprises a broadband optical signal.

42. The method according to Claim 41, further comprising receiving said optical signal from an edge-emitting light emitting diode (EELED).

43. The method according to Claim 38, wherein said characteristic comprises one or more properties selected from the group consisting of amplitude, absorption, frequency, wavelength, phase, polarization, group delay, scattering, reflection, dispersion and bandwidth.

44. The method according to Claim 43, wherein said determining a characteristic of said optical signal is adapted to calibrate a measurement instrument as a function of said one or more properties.

45. The method according to Claim 43, wherein said determining a characteristic of said optical signal is adapted to calibrate a property of a light source as a function of said one or more properties.

46. A method of spectroscopy comprising:

propagating a known optical signal along a holey fiber containing a substance under test;

determining an absorption, experienced by said optical signal, as a function of the wavelength; and

identifying said substance under test, as a function of said absorption.

47. The method according to Claim 46, wherein said known optical signal comprises a tunable narrowband optical signal having a wavelength varying as a function of time.

48. The method according to Claim 46, wherein said known optical signal comprises a broadband optical signal.

49. The method according to Claim 46, wherein said substance under test is introduced into a plurality of voids formed in said holey fiber optic cable utilizing a fill hole having a first opening in said plurality of voids and having a second opening couplable to a source of said substance under test.